

LABYRINTHS AND ADDITION OF BORON TO ACCELERATOR ENCLOSURE WALLS:
Resume of some conversations with Dr. R. McCall, head of the
health physics group at SLAC

M. Awschalom

February 21, 1968

1. Neutrons Streaming Through Labyrinths. They found Price's formulae inaccurate. They use $(1/R)^2$ and a factor of $(1/20)$ for each 90° bend. This gives good agreement with measurements. This recipe applies to neutron dose.

Author's note: They measured over a small "delta-R" far from linac. Experience has taught that under those circumstances any formula will give "a good fit" if 30% deviation is considered "good".

Measuring instrument: $B^{10}F_3$, moderated with 6 cm of polyethylene. This instrument has a non flat response which peaks towards the low energy (~ 10 KeV) region.

2. Neutron Source. The most important neutrons from the point of view of wall activation and streaming are the giant resonance neutrons (1-5 MeV energies). Giant Resonance Neutron Production = 1 neutron/5 GeV, for $E_e > 30$ MeV, and thick targets (more than one radiation thick). Thin target formulae do not work well. (This may be due to the integration of an unknown photoneutron cross-section over the bremsstrahlung spectrum.) A rule that seems to work: Use thick target yield formula and scale accordingly to actual target thickness. At times, this may overestimate the neutron flux by a factor of 10.

3. Exposure Dose from Walls. They have a section of tunnel wall near the positron source ($E_e \sim 7$ GeV), with boron in the concrete. They have looked for differences in the exposure dose rate from that section and neighboring ones. Their measurements failed to disclose any difference between boron loaded and ordinary concretes.
4. Air Problems. No problems have been found so far with air radioactivation or nitrogen oxides or HNO_3 or O_3 .
5. Beam Stop. Above 20 kW they begin to get explosive mixtures of H_2 and O_2 from hydrolysis. Below this power level, normal purging keeps trouble away. Above this power level, the amount of O^{15} , C^{11} (1 curie/sec) makes purging impractical.
6. Dose in Reentrant Accesses. Ionization chambers, three feet from the tunnel wall (inside reentrant part of tunnel) read 10 - 20 mrad/hr during machine operation. This is large angle doses from the linac.